

THE UNIVERSITY OF MANITOBA

COMPARISONS OF MODIFIED FORWARD CHAINING
AND TOTAL TASK PRESENTATION FORMATS
TO TEACH VOCATIONAL SKILLS TO THE RETARDED

by

Dickie C.T. Yu

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Master of Arts

James Martin
.....
Advisor

Joseph J. Pear
.....
.....

Edward [unclear]
.....
External Examiner

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CHUNG TONG DICKIE YU

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ABSTRACT

Three experiments were conducted, using a multi-element baseline design, to compare a modified forward chaining (MFC) procedure to total task presentation (TTP) procedure in teaching assembly tasks to retarded clients. The assembly tasks included a 13-part bicycle brake and a 13-part fishing reel for Experiment I; a 5-part Lego car and a 5-part Lego man for Experiment II; and two 20-part abstract Lego designs for Experiment III. Generally, MFC was found to be superior in training steps to initial step criterion and to the final task criterion with fewer steps contacted (steps that the subject was required to perform were counted as contacted a maximum of once per trial). The amount of time the subjects spent actually working with the tasks was also found to be less in MFC. However, the trainer required more time to apply the MFC procedure. This resulted in minimal differences between the procedures when total training time was considered. Overall, subjects had fewer errors in TTP and minimal differences were found in the work rate (speed) of the subjects in the two procedures. In addition, no apparent differences were revealed in the retention tests and no systematic interactions between the procedures and task complexity were noted across the three experiments. Finally, some implications of the present study were discussed and further modifications and examinations of training procedures were suggested.

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INTRODUCTION

Various training procedures such as forward chaining (FC), backward chaining (BC), and total task presentation (TTP) have been employed to teach the mentally handicapped to acquire self-care skills (Martin, England & England, 1971; Martin, Kehoe, Bird, Jensen & Darbyshire, 1971), and vocational skills (Gold, 1972, 1974, Note 1). Typically, these procedures involve breaking down a task into a number of smaller steps arranged in a sequence appropriate for the level of functioning of the client. In FC, the first step in the sequence is taught first; then the first two steps are linked together; then the first three steps; and so on until the end of the chain is reached. BC proceeds in a reverse order; that is, the last step is established first; then the last two steps are linked together; then the last three steps; and so on progressing backwards towards the beginning of the chain. In TTP, the client simply performs all the steps from the beginning to the end of the chain on each attempt.

Previous studies that compared training procedures have primarily used normal subjects and various verbal or non-motor tasks such as programmed materials in mathematics (Balson, 1971), poetry (Hartley & Woods, 1968), and the Markov prediction task (Naylor & Briggs, 1963). Findings were generally inconsistent and generalizations to the vocational training of the mentally handicapped were greatly limited. Blake and Williams (1969) compared FC, TTP, and a pure-part procedure (i.e., each step or component was taught in isolation and then they were combined) using retarded, normal, and superior subjects. The authors reported that the best performance occurred in the superior group, then the normal group, and then the retarded group. For all three groups, TTP was superior while the other two procedures did not differ. Although the level of functioning of the retarded subjects was not specified, it seemed that

they were quite high functioning judging from the nature of the task (paired-associate task using CVC trigrams as stimuli, and three digit numerals as responses). Nettelbeck and Kirby (1976) also compared FC, TTP, and pure-part procedures in teaching mildly retarded clients to thread an industrial sewing machine which consisted of 12 steps grouped together into four components. Both FC and pure-part procedures were found to be superior to TTP in errors and total training time. Some indications that FC was better than pure-part were present; however, the difference was not statistically significant. Furthermore, no difference was found in retention for all three groups. Weber (1978) compared FC and BC in teaching retarded clients to perform a simple assembly task. The task was a science kit which included some cranks and gears, with six parts in total. Results showed that BC was superior to FC in having fewer errors. Walls, Zane and Ellis (Note 3) also trained retarded clients on simple task assemblies using FC, BC, and TTP. The three assemblies, each consisting of six parts, were a meat gringer, a carburettor, and a bicycle brake. The two chaining procedures were found to have fewer errors than TTP, and BC was slightly superior to FC. However, the overall training time was similar among the training methods. It was suggested that the chaining procedures placed a restriction on the rate of acquisition in that the minimum possible trials were fewer for total task presentation.

A recent literature review on behavior modification in sheltered workshops (Martin & Pallotta-Cornick, 1979) indicated a lack of research in examining various training procedures in this area. Such research was suggested and viewed to be essential for the development and dissemination of a training technology. Following one of the suggestions by Martin

and Pallotta-Cornick, a study was conducted to compare FC and BC in teaching complex assembly tasks to retarded clients (Pallotta-Cornick, Martin, Suthons & Yu, Note 2). A 13-part bicycle brake and a 13-part fishing reel were used, and each task was broken down into 28 steps. Results were confounded by a task effect (i.e., the bicycle brake was easier to learn than the fishing reel). In spite of this, BC was found to have slightly fewer errors. Yu, Suthons, Pallotta-Cornick and Martin (Note 4) taught retarded clients the same tasks as in the previous study using FC and TTP. Regardless of the task being trained, the percentage of errors were twice as high in TTP than in FC, and subjects performed faster during training when the FC procedure was used. However, the total training time did not differ between the two procedures. These findings were similar to those reported by Walls et al. (Note 3). Yu et al. also noted that the FC format itself restricted the speed of acquisition in that the minimum possible trials (and steps contacted) to learn the task were greater than in TTP because subjects spent more time in repeating steps that were already learned.

Based on the findings reported by Yu et al., the present study compared TTP to a revised forward chaining procedure. It was presumed that by decreasing the amount of repetition of learned steps, and retaining the feature of teaching one step at a time, the effectiveness of the traditional FC procedure might be improved.

EXPERIMENT I

Method

Subjects and Setting

Four mentally retarded clients from the Manitoba School for the Retarded served as subjects (see Table 1). Two of the subjects

Insert Table 1 about here

had some previous sheltered workshop experience which included mainly simple packaging tasks. None of the subjects had prior experience with the experimental tasks.

Sessions were conducted in a room measuring approximately 6 m X 6 m, located at the Manitoba School. To minimize distractions, the training area had two small areas separated from each other by partitions. The experimenter and the subject were seated side by side, with the task materials located on a table in front of them.

Task Materials

A three-speed bicycle brake and a spin-cast fishing reel were used as experimental tasks. These were essentially the same tasks used by Yu *et al.* (Note 4). Some particularly difficult steps in the fishing reel were identified in the previous study, and were modified and/or eliminated as a further attempt to equate the tasks in terms of difficulty.

In this study, each task consisted of 12 parts and was broken down into 26 steps (see Figures 1 and 2 for task analyses). A training tray

Insert Figures 1 and 2 about here

approximately 1.3 m long with 13 compartments was used to hold the parts

Table 1

Description of Subjects for Experiments I, II, and III

Subject	Sex	Age	I.Q. (test)	Level of Retardation	Diagnosis	Workshop Experience	Years of Institutionalization
<u>Experiments I and II</u>							
S ₁	F	12	40 (S-B)	moderate	Autism		5½
S ₂	F	22	MA: 2 yr 9 mo (S-B)	severe	Down's Syndrome	some	11
S ₃ *	F	24	MA: 3 yr 9 mo (S-B)	severe	Infection and intoxication toxemia of pregnancy and environmental influence	minimal	13
S ₄	F	20	MA: 2 yr 7 mo (S-B)	severe	Gargoylism with congenital lymphedema		8
<u>Experiment III</u>							
S ₅	F	20	41 (WAIS)	moderate	Unknown prenatal influence	some	8
S ₆	M	16	MA: 3 yr 0 mo (S-B)	severe	Chromosomal abnormality Down's Syndrome	some	8
S ₇ *	F	24	MA: 3 yr 9 mo (S-B)	severe	Infection and intoxication toxemia of pregnancy and environmental influence	minimal	13
S ₈	F	26	24 (S-B)	severe	Chromosomal abnormality Down's Syndrome	some	20

* Subject 3 also participated in Experiment III as Subject 7.